Docket No. MSN-32778

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant (s)	:	Stefan Miersch
Serial No.	:	10/008,603
For	:	Method and Apparatus for Producing Methane Gas
Filed	:	November 9, 2001
Examiner	:	Thanh P. Duong
Group Art Unit	:	1764
Confirmation No.	:	9226

CERTIFICATION OF SUBMISSION

I hereby certify that, on the date shown below, this correspondence is being transmitted via the Patent Electronic Filing System (EFS) addressed to Examiner Thanh P. Duong at the U.S. Patent and Trademark Office.

Date: May 22, 2006

M. L. Polmatier

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AMENDED APPEAL BRIEF UNDER 37 C.F.R. §41.37

This is an appeal from the final rejection of Claims 7-12 as stated in the Office Action mailed January 11, 2005. The Notice of Appeal was timely filed on April 27, 2005.

I. REAL PARTY IN INTEREST

The real party in interest is Miller-St. Nazianz, Inc.

II. RELATED APPEALS AND INTERFERENCES

There are no related applications currently either under appeal or the subject of an interference proceeding.

III. STATUS OF CLAIMS

All the claims of this application and their individual status are reported in Appendix I to this Appeal Brief. Claims 7-12 are on appeal.

IV. STATUS OF AMENDMENTS AFTER FINAL

All amendments have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The current invention is a system and method of generating methane gas from organic material, e.g., animal waste. A mixture known to product methane gas which may include animal waste and vegetation as desired, is treated, also as desired, with an inoculant and inserted into a plastic bag. A portion of the plastic bag is left unfilled with the organic material to produce a collection space for collecting the gas. As the gas is generated, the gas migrates to the provided space and is typically removed, via tube or pipe, for collection and use as an energy source. An upper passage provided in the material enhances migration of the gas to the provided space.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issue on appeal is whether or not the following final rejections are in error:

Claims 7-8 and 11-12 were finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Garvin et al. (US 5,461,843) in view of Bremmer (US 4,579,654) and Chow (US 4,157,958).

Claim 9 was finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Garvin et al. in view of Bremmer and Chow and further in view of Courtland (US 3,981,803).

Claim 10 was finally rejected under 35 U.S.C.§ 103(a) as being unpatentable over Garvin et al. in view of Bremmer and Chow in view of Courtland and further in view of Pogoda (US 4,267,147).

Claims 8-12 depend from independent Claim 7 and are therefore allowable over the prior art if Claim 7 is so allowable. Furthermore, all of the claims stand or fall together in this appeal. Therefore, although the Examiner provided separate support and/or rejections for the elements in each claim, only the rejection of Claim 7 is relevant.

VII. ARGUMENT

The Applicant believes that the Examiner's rejections are in error both from technology and legal grounds. First, the Examiner has misunderstood both the teachings of the primary reference and the fundamental science underlying the methane gas generation. Second, the proposed modification of the primary reference would completely alter the principle of operation of the primary reference and render the invention of that reference unsuitable for its original purpose. Third, the proposed modification would not work as either the original invention or as the invention currently under appeal. Fourth, if the proposed modification did work as the current invention, the result would potentially be a highly explosive mixture. Therefore, the Applicant requests that the Examiner's rejections be overturned.

ERROR 1: The rejection of Claims 7-12 under 35 U.S.C. §103(a) is in error because the proposed *prima facie* case is insufficient and also legally barred.

The Appellants believe that the Examiner has failed to meet the standards for an obviousness rejection and, therefore, has not established a *prima facie* case of obviousness.

A. Requirements for a *Prima facie* Case of Obviousness

The Examiner's fundamental error in rejecting the claims on appeal is that he has failed to establish a *prima facie* case of obviousness.

> In rejecting claims under 35 U.S.C. §103, the examiner bears the initial burden of presenting a *prima facie* case of obviousness . . . 'A *prima facie* case of obvious-

> ness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art . . .'" *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993).

Specifically, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. See *In re Royka*, 180 USPQ 580 (CCPA 1974). In addition, in order to establish a *prima facie* case of obviousness, the Examiner must show some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. *See, e.g., In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Furthermore, in leading one skilled in the art, the prior art must suggest to the ordinary skilled artisan that the combination should be carried out and would have a reasonable likelihood of success, viewed in the light of the prior art. *In re Dow Chemical Co*, 5 USPQ2d 1529, 1532 (Fed. Cir. 1988)(emphasis added). Indeed, both the suggestion and the expectation of success must be found in the prior art, not in the Appellant's disclosure. Id. Additionally, the Federal Circuit has stated that a reference should be considered in its entirety, with due consideration given to disclosures that diverge or teach away from the invention as well as disclosures which direct one skilled in the art to the invention. *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 227 U.S.P.Q. 657, 669 (Fed. Cir. 1985).

Furthermore, certain combinations or types of modifications of the prior art are legally barred to prevent the USPTO from applying improper hindsight to the obviousness determination. Relevant here, if proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Equally relevant, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

B. Final Rejection

Claim 7 (and Claims 8 and 11-12) was finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Garvin et al. (US 5,461,843) in view of Bremmer (US 4,579,654) and Chow (US 4,157,958). The Examiner states that "Garvin discloses a system for generating methane gas … from compost," the system comprising: a flexible bag having an open end; the bag having a horizontally extended tube length, the majority of which is "filled with a substantially non-flowable biomass material (compost) in a composition known to produce methane gas (gas generated from compose) (sic)." Internal citations omitted. The Examiner further states that Garvin teaches that the remaining tubular length of the bag is unfilled with the material and that "the bag is tied off and filled with said gas emitted by biomass material (compost)." The Examiner admits certain limitations of the claims are not found in Garvin but he cites the secondary references for the missing disclosures.

C. Reasons the Rejection is in Error

The Applicant believes that all of these rejections are improper because the Examiner has misread Garvin and because the proposed modifications of the primary reference, Garvin et al., are legally barred. In particular, the Applicant believes that the proposed modifications change the principle of operation of Garvin et al. and also, the modified invention of Garvin et al. would be unsuitable for the purpose of the invention of Garvin et al.

The misreadings and technological inaccuracies of the Examiner's rejections are numerous. First, Garvin does not disclose a "system for generating methane gas," but, rather, never even mentions methane anywhere in the patent document. Second, the biomass material in Garvin is not "in a composition known to produce methane gas" as the Examiner asserts. The compost composition of Garvin is highly oxygenated (the system in Garvin provides a constant supply of oxygen to aid the decomposition or drying of the biomass). In contrast, methane generation from compost is an anaerobic process that must occur in the absence of oxygen (see

Evidence Appendix, Methane Generation From Livestock, R.W. Hansen). Clearly, an oxygenated composition cannot be a "composition known to produce methane gas." Moreover, the Applicant cannot find any reference in Garvin to tying off the bag and letting the unfilled space fill with gas emitted by the biomass material. Rather, as described more fully below, the bag in Garvin is vented and air is forced from a conduit through the material and out of the vent. These technical and understanding errors are at the heart of the improper rejections.

Second, as stated in the Abstract, Garvin et al. disclosed:

> "A method and apparatus for treating bagged materials" A... conduit... through the open end of the bag and into the bag... is perforated and when the bag is filled, the length of the conduit is extended out through the bag end to be connected to a treatment media, e.g., forced air. An opening is provided at the rear end to provide an exhaust opening for air that is forced into the conduit, out the perforations and through the bagged material. The air will dry the material to lower the moisture content or provide oxygen as may be desired to enhance decomposition."

Therefore, based on the abstract and FIG. 1, in at least one embodiment, the principle of operation for the invention of Garvin et al. is forcing air through a perforated conduit that extends through a bag of bagged materials such that the forced air from the perforated conduit flows through the bagged materials prior to escaping through an open vent. As stated in the specification the forced air is "vented to the atmosphere as indicated by arrows 36." See col. 4, lines 20-26. The purpose of this embodiment of Garvin et al. is to either dry the bagged material or provide oxygen to facilitate decomposition of the bagged material. See the abstract.

As such, the proposed combination of references will impermissibly alter the principle of operation of Garvin et al. Instead of forcing air through the perforated conduit and then through the bagged material and then exhausting through a vent to the atmosphere, the modifications would require that the vent 34 be eliminated so that the methane gas emitted by the biomass

would be able to remain within the bag to be collected through the perforated conduit. Also, instead forcing air through the conduit and into the biomass material, the modified combination would require that methane gas from the bag flow through the conduit to a collection site. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Next, the proposed combination of references would render the modified disclosure of Garvin et al. unsuitable for the purpose of Garvin et al. Specifically, air would no longer be forced through the biomass and into the atmosphere to remove gases emitted from the biomass (water vapor and/or decomposition products). Note also, the presence of oxygen hinders the production and collection of methane due at least in part to the rapid and spontaneous reaction of methane with oxygen and also to the anaerobic process for producing methane. Therefore, excluding oxygen by not forcing air through the biomass would not be satisfactory for the purpose of providing oxygen to enhance desired decomposition. If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Third, as mentioned above, methane is generated by an anaerobic process. Modifying the aerobic process of Garvin, as proposed by the Examiner, will still result in an aerobic process. Such an aerobic process will not function to produce methane.

Fourth, even if the proposed modifications would produce methane, the user would be left with an air-methane mixture. Such air-methane mixtures are known to be potentially highly explosive at methane concentrations of 6 to 15 percent (see Exhibit 2). One skilled in the art of

composting would not be motivated to modify a prior art invention to make potential bombs out of their users farms.

For the above reasons, the Applicant believes that the Examiner's *prima facie* cases of rejection, all of which are based on Garvin et al., fail.

For the reasons stated in the above argument, Appellants believe that the claims on appeal comply with 35 U.S.C. §103(a), and they request that the final rejection of the claims on appeal be reversed. Also requested is reconsideration of the Information Disclosure Statement filed on April 23, 2002 which is being refilled electronically this date and a copy of which is attached as Appendix III to this Amended Appeal Brief.

Respectfully submitted,

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Date: May 22, 2006

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APPENDIX I

CLAIMS APPENDIX

1. (Previously presented) A method for producing methane gas which comprises:

providing a biomass material that will yield methane gas;

adding or not adding inoculants as desired and inserting the biomass material into a large flexible plastic bag having a horizontally extended tubular length to provide a first portion of the bag filled with the biomass material and sealing off both ends of the bag to provide a second bag portion at one end that is unfilled with the material;

said material emitting methane gas that is directed to the second bag portion;' connecting a tube into the bag at the unfilled bag portion with an end of the tube protruded from the bag; and

directing methane gas from the bag and through the tube to a point of collection or use.

2. (Original) A method as defined in Claim 1 including placing a perforated conduit inside the bag along the top of the filled portion of the bag and extended to the unfilled portion of the bag and thereby facilitating flow of the gas to the unfilled portion.

3. (Original) A method as defined in Claim 1 including placing aeration tubes in the biomass material in the filled portion of the bag and extending an end thereof to the bag exterior and compost treating the material following substantial extraction of the methane gas from the material.

4. (Original) A method as defined in Claim 1 including filling multiple bags with the biomass material in accordance with Claim 1 and further including a gas line interconnected with the multiple tubes of said multiple bags and conveying methane gas through the gas line to a collection site.

5. (Original) A method as defined in Claim 1 including placing the bag on a heating pad while being filled and upon being filled, directing hot water to the heating pad to heat the filled bag as desired and to enhance the reaction of the methane gas production.

6. (Original) A method as defined in Claim 1 which includes placing an insulating robe over the bag, inserting water lines between the robe and bag and flowing hot water through the lines to achieve a desired temperature of the material in the bag.

7. (Previously presented) A system for generating methane gas which comprises:

a flexible bag having an open end for mounting to a bag filling machine for filling and compacting the bag with non flowable material, said bag having a horizontally extended tubular length, a majority of said length filled with substantially non-flowable biomass material in a composition known to produce methane gas and as desired adding an inoculant to the material that induce a reaction with the biomass material to include methane gas emission from the biomass [[material.]] material;

a remaining tubular length of the bag as removed from said machine being unfilled with the [[material]] material, said open end tied off and to be filled with said gas emitted by the biomass material, a pipe inserted through the bag wall where filled with said gas for releasing methane gas from the remaining tubular length and a continuation of said pipe directing said gas to a gas collection site.

8. (Original) A system as defined in Claim 7 wherein a conduit is positioned inside the bag at the top of the material in the filled tubular length and extended to the unfilled tubular length for transmitting as to the unfilled tubular length.

9. (Original) A system as defined in Claim 8 wherein a heating bag underlies the bag, water passages are provided in the pad and connected to a hot water source for flowing hot water through the pad and heating thereby the material in the bag.

10. (Original) A system as defined in Claim 9 wherein a robe is placed over the bag, water lines are positioned between the bag and robe and hot water is circulated through the lines for heating the material in the bag.

11. (Original) A system as defined in Claim7 wherein multiple of the defined bags are placed in adjacent relationship and a gas line is connected to the pipes and extended to a collection site for transmitting gas from the bag to the collection site.

12. (Original) A system as defined in Claim 7 wherein the dominant portion of the biomass material is animal waste.

APPENDIX II

EVIDENCE APPENDIX

no. 5.002

Methane Generation From Livestock Wastes

by R.W. Hansen [1]

Quick Facts...

- Anaerobic fermentation or digestion is the most promising process for converting organic materials to methane and other gases.
- A simple apparatus can be constructed to produce bio-gas.
- Bio-gas usually contains about 60 to 70 percent methane, 30 to 40 percent carbon dioxide, and other gases.
- The heat value of raw bio-gas is approximately half that of natural gas under typical Colorado conditions.
- Take precautions when processing and handling the gas. It is highly explosive and difficult to detect.

Energy conservation, coupled with concern for the management of livestock wastes, has revived an interest in generating methane from livestock manures.

Converting organic materials, such as animal wastes, to an easily used form of energy can be accomplished by several methods. The process with the greatest potential is anaerobic fermentation or digestion.

The extraction of energy from wastes using anaerobic digestion to produce bio-gas is not new and the general technology is well known. Bio-gas, which is methane and other gases, has been known as swamp gas, sewer gas and fuel gas. Sewage treatment plants generate bio-gas from the sewage sludge as part of the sewage treatment processes. Many small units were used in Europe and India after World War II.

Characteristics of Bio-Gas

Bio-gas usually contains about 60 to 70 percent methane, 30 to 40 percent carbon dioxide, and other gases, including ammonia, hydrogen sulfide, mercaptans and other noxious gases. It also is saturated with water vapor.

The heat value of the raw gas at typical Colorado atmospheric pressures is about 400 to 600 British thermal units (Btu) per cubic foot. In comparison, natural gas has a heat value of 850 Btu per cubic foot and gasoline contains approximately 120,000 Btu per gallon. Partial removal of the impurities may be required. This is not necessarily difficult, but it does complicate the system.

Basic Digester Process

Methane is produced by bacteria. The bacteria are anaerobes and operate only in anaerobic environments (no free oxygen). Constant temperature, pH and fresh organic matter promote maximum methane production. Temperatures usually are maintained at

approximately 95 degrees F. Other temperatures can be used if held constant. For each 20 degrees F decrease, gas production will be cut approximately one half or will take twice as long. A constant temperature is critical. Temperature variations of as little as 5 degrees F can inhibit the methane-formers enough to cause acid accumulation and possible digester failure.

Anaerobic digestion is a two-part process and each part is performed by a specific group of organisms. The first part is the breakdown of complex organic matter (manure) into simple organic compounds by acid-forming bacteria. The second group of microorganisms, the methane-formers, break down the acids into methane and carbon dioxide. In a properly functioning digester, the two groups of bacteria must balance so that the methane-formers use just the acids produced by the acid-formers.

A simple apparatus can produce bio-gas. The amount of the gas and the reliability desired have a great influence on the cost and complexity of the system. A simple batch-loaded digester requires an oxygen-free container, relatively constant temperature, a means of collecting gas, and some mixing. Because methane gas is explosive, appropriate safety precautions are needed.

Tank size is controlled by the number, size and type of animals served, dilution water added, and detention time. The factor that can be most easily changed with regard to tank size is detention time. Ten days is the minimum, but a longer period can be used. The longer the detention time, the larger the tank must be. Longer detention times allow more complete decomposition of the wastes. Fifteen days is a frequently used detention time. Table 1 shows some recommended sizes, dilution ratios and loading rates for different types of animals.

Little volume reduction occurs in an anaerobic digester. Waste fed into the digester will be more than 90 to 95 percent water. The only part that can be reduced is a portion of the solids (about 50 to 60 percent).

The processed material will have less odor. Because it still contains most of the original nitrogen, phosphorus and potassium, and is still highly polluted, the waste cannot enter a stream after it leaves the digester. Lagoons are commonly used to hold the waste until it can be disposed of by either hauling or pumping onto agricultural land.

Table 1: Loading rate guidelines for heated, mixed anaerobic digesters at 95 degrees F being fed fresh livestock manures.*

Factor	**Swine (growing-finishing)**	**Dairy**	**Beef under 700 lbs**	**Poultry layer**	**Poultry broiler**
Dilution ratio manure (manure to water)	1:2.9	Undiluted	1:2.5	1:8.3	1:10.2
Estimated dilution water (gal water/1,000 lbs body wgt)**	15	0	11	47	79
Hydraulic detention time (days)	12.5	17.5	12.5	10	10
Loading rate (lbs volatile solids/cubic foot/day)**	0.14	0.37	0.37	0.13	0.1
Digester volume (cubic feet/1,000 lbs animal wgt) **	30	24	14	72	120

*(From R.J. Smith, The Anaerobic Digestion of Livestock Wastes and the Prospects for Methane Production, Midwest Livestock Waste Management Conference, ISU, Ames, Iowa, Nov. 27-29, 1973)

**To convert to metrics use the following equivalents: 1 gal = 3.8 l; 1 lb = .45 kg; 1 cu ft = .03 cu m.

The volume of effluent actually may be greater than the volume of manure prior to digestion. This increase is due to the dilution water added to liquefy the manure to the desired solid content for the digester.

There is no increase in the amount of nitrogen, phosphorus or potassium in this material, although it may be in a more available form. A small portion of the nitrogen may be lost to the gas portion of the system, thus reducing the amount of nitrogen initially available.

Gas Production

Total bio-gas production varies depending on the organic material digested, the digester loading rate, and the environmental conditions in the digester. Under ideal conditions (95 degrees F temperature and proper pH), it is possible to produce about 45 cubic feet of gas at atmospheric pressure from one day's manure from a 1,000 pound cow. Not all of the bio-gas energy is available for use. Energy is required to heat and mix the digester, pump the effluent, and perhaps compress the gas. Table 2 summarizes the estimated gas production from various animal wastes.

Table 2: Bio-gas production (60% methane and 40% carbon dioxide) from animal wastes per 1,000 pounds body weight.

Animal	Volatile solids (lb per animal per day)	Probable volatile solids destruction (percent)[1]	Gas (cu ft per day)	Btu (per day)[2]
Beef	5.9	45	30	18,000
Dairy	8.6	48	44	26,000
Poultry, layers	9.4	60	72	43,000
Poultry, broilers	12.0	60	92	55,000
Swine (growing-finishing)	4.8	50	29	17,400

[1]Percent destruction of volatile solids varies depending primarily on detention time and digester temperature.

[2]Calculated at 600 Btu/ft^3* (heat content varies depending on quality of gas). For comparison, some other heating values are: gasoline, 124,000 Btu/gal; diesel fuel, 133,000 Btu/gal; natural gas, 850 to 1,000 Btu/ft^3; propane, 92,000 Btu/gal.

*To convert to metrics, use the following equivalents:
1 lb = .45 kg; 1 cu ft = .03 cu m; 1 gal = 3.8 1.

Basic Elements

Figure 1 shows the basic elements of a single-stage anaerobic digester. Submerged inflow and outflow lines are needed to prevent gas from escaping. Either a mechanical mixer can be used, or the liquid or gas can be recirculated for mixing.

A heat exchanger and thermostat maintain the proper temperature. The heat exchanger can be either internal or external.

Methane is drawn off the top of the digester. For gas utilization, a compressor and storage tank are used, along with the hardware to provide flame traps, regulators, pressure gauges, hydrogen sulfide scrubber, carbon dioxide removal and pressure relief valves. A common facility for gas storage is the floating cover that floats upward while maintaining essentially constant pressure.

Methane or bio-gas cannot be converted to a liquid under normal temperatures as can LP gas (LP gas liquefies at 160 psi). Under constant temperature, volume reduction is

inversely proportional to the pressure; that is, as the pressure doubles, the volume becomes half as large. The more the gas is compressed, the more energy it takes to compress it.

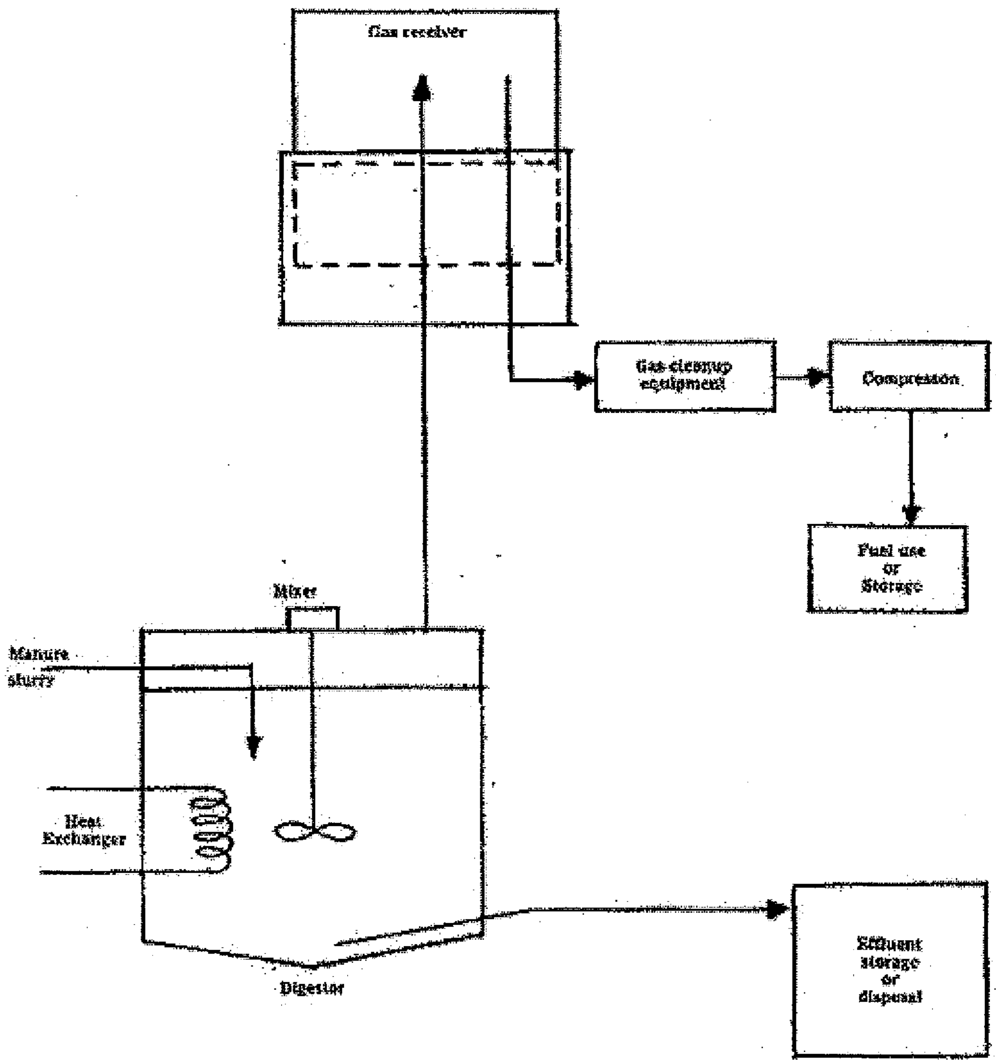

Figure 1: Basic components of anaerobic digester.

Liquefaction of methane requires pressures of nearly 5,000 psi and is not practical. If the gas is compressed to just 1,000 psi, it requires about 1,320 Btu of energy to put 6,350 Btu into a storage container.

Because bio-gas cannot be liquefied, it is best suited for stationary uses, such as cooking, heating water and buildings, air conditioning, grain drying, or operating stationary engines. It is not feasible as a tractor fuel. One cubic foot of compressed bio-gas at 3,000 psi would run a 100-horsepower tractor approximately 7 1/2 minutes. Most tractor fuel tanks occupy about 8 cubic feet. A special high-pressure tank with 8 cubic feet of gas and 3,000 psi would run the tractor approximately one hour. A 3,000-psi tank bouncing around on a tractor would present a serious safety hazard. The tractor would run 6 minutes on 8 cubic feet of gas compressed to 300 psi, a more realistic pressure.

A well-insulated, three-bedroom home takes about 900,000 Btu per day for heating during cold weather. Because 50 percent of the bio-gas goes back into maintaining the necessary temperature of the digester, it would take the manure from 50 cows to

produce enough bio-gas each day for home heating.

Bio-gas is produced on a relatively constant basis. Most applications are somewhat intermittent; therefore, storage is required. The amount of storage depends on the storage time and pressure. High demand applications, such as grain drying, normally are impractical due to the excessive storage capacity required.

Hazards

Methane in a concentration of 6 to 15 percent with air is an explosive mixture. Since it is lighter than air, it will collect in rooftops and other enclosed areas. It is relatively odorless and detection may be difficult. Extreme caution and special safety features are necessary in the digester design and storage tank, especially if the gas is compressed.

Summary

Concerns for energy conservation, environmental pollution, and the fact that agricultural organic wastes account for a major portion of our waste materials, has created renewed interest in the processing of these wastes for energy recovery.

Of the several types of energy capturing processes available, anaerobic digestion appears to be the most feasible for the majority of agricultural operations. Anaerobic digestion can stabilize most agricultural wastes while producing bio-gas or methane gas. This concept has been extensively applied in Europe and India during energy shortages. Similar equipment has been used for gas production with domestic wastes.

Primarily, disadvantages are the amount of management required due to the sensitivity of the digesters, the high initial investment required for equipment, and the fact that the wastes still must be disposed of after digestion.

Research is in progress to make the process more practical for energy production. Bacteriologists are investigating new strains of bacteria and culturing techniques for producing methane. Engineers are investigating digester designs and operation to reduce construction and operational requirements and costs.

[1] R.W. Hansen, former Colorado State University Cooperative Extension specialist and associate professor. 9/92. Reviewed 1/03 by L.R. Walker, Cooperative Extension specialist, chemical and bioresource engineering.

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Updated Tuesday, October 19, 2004.

APPENDIX III

Attached is a copy of the Information Disclosure Statement and Form PTO-1449 which prior counsel attempted to file on April 23, 2002, and which has been electronically re-filed on today's date. Although the foreign references have already been made of record with the USPTO on November 9, 2001, copies have been properly re-filed with the Information Disclosure Statement for your reconsideration.

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT (Under 37 CFR 1.97(b) or 1.97(e))			Docket No. 000594-126753
In Re Application Of: Miersch, et al			
Serial No. 10/008,603	Filing Date 11/9/01	Examiner	Group Art Unit 1764
Title: METHOD AND APPARATUS FOR PRODUCING METHANE GAS			

Address to:
Assistant Commissioner for Patents
Washington, D.C. 20231

37 CFR 1.97(b)

1. ☒ The Information Disclosure Statement submitted herewith is being filed within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53(d); within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; before the mailing of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

37 CFR 1.97(c)

2. ☐ The Information Disclosure Statement submitted herewith is being filed after the period specified in 37 CFR 1.97(b), provided that the Information Disclosure Statement is filed before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application, and is accompanied by one of:

   ☐ the statement specified in 37 CFR 1.97(e);

   OR

   ☐ the fee set forth in 37 CFR 1.17(p).

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT (Under 37 CFR 1.97(b) or 1.97(c))			Docket No. 000594-126753
In Re Application: Miersch, et al			
Serial No. 10/008,603	Filing Date 11/9/01	Examiner	Group Art Unit 1764
METHOD AND APPARATUS FOR PRODUCING METHANE GAS			

Payment of Fee

(Only complete if Applicant elects to pay the fee set forth in 37 CFR 1.17(p))

- ☐ A check in the amount of is attached.
- ☐ The Assistant Commissioner is hereby authorized to charge and credit Deposit Account No. as described below. A duplicate copy of this sheet is enclosed.
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INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Atty. Docket No.: 000594-126753	Application Number: 10/008,603
	Applicant(s): Miersch, et al	
	Filing Date: 11/9/01	Group Art Unit: 1764

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	Translation YES	Translation NO
		DE 299 02 143 U	9/2/909	Germany				✓
		FR 2 461 747 A	7/24/79	France				✓
		DE 100 05 390 A	7/2/00	Germany				✓

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

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(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENT- UND MARKENAMT

(12) Gebrauchsmuster

(10) DE 299 02 143 U 1

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(73) Inhaber:
Rück, Werner, 91732 Merkendorf, DE; Hoffmann, Manfred, Prof. Dr., 91746 Weidenbach, DE

(54) Vorrichtung zur Methanisierung von Substraten unterschiedlicher Konsistenz in einem kontinuierlich bzw. semikontinuierlich arbeitenden Gleitschicht-Fermenter

DE 299 02 143 U 1

DE 299 02 143 U 1

Vorrichtung zur Methanisierung von Substraten unterschiedlicher Konsistenz in einem kontinuierlich bzw. semikontinuierlich arbeitenden Gleitschicht-Fermenter

Beschreibung

Zur Biogasgewinnung werden methanisierbare Biomassen (z. B. Gülle oder Klärschlämme) entweder in flüssiger Form (Flüssig-Vergärung) oder in halbfeuchter Form (Trocken-Vergärung) in Fermentern mikrobiologisch genutzt. Die im landwirtschaftlichen oder kommunalen Bereich favorisierte Flüsssig-Vergärung von Gülle oder Klärschlamm ist vorwiegend auf deren betriebsinterne Verwertung abgestellt. Wegen der geringen Energiedichte z. B. der Gülle lohnt sich kein Transport, was im Regelfall durch die Größe dieser Anlagen deren Wirtschaftlichkeit begrenzt. Andererseits müssen ausbeutungswürdige Biomassen (z. B. Rasenschnitte) aus außerlandwirtschaftlichen Bereichen erst in einen pumpfähigen Zustand gebracht und auch als Flüssigkeit auf den landwirtschftlichen Nutzflächen verteilt werden.
Zur Trockenen Vergärung sind mehrere Verfahrens-Varianten bekannt:
- diskontinuierlilche Batch-Verfahren und
- kontinuierliche bzw. semikontinierliche Verfahren

Den kontinuierlichen bzw. semikontinuierlichen Verfahren ist gemeinsam, daß der Substrattransport im Fermenter entweder über Schwerkraft (fall down-Prinzip), mechanisch (Transportschnecke oder Zinkenförderer) oder in geschobenen Spezialbehältern und die Substrat-Homogenisierung mit Rührwerken oder durch Gaseinpressung erfolgen.
Bei der vorliegenden Erfindung handelt es sich um eine Vorrichtung zur wahlweisen Flüssigen oder Trockenen Vergärung in einem Gleitschicht-Fermenter, welcher im Längsprofil (Fig. 1) und Querschnitt (Fig. 2) vorgestellt wird. Dabei wird von einem stufenlos steuerbaren kontinuierlich arbeitenden Vergärungsverfahren ausgegangen, welches mit einem Minimum an technischen Vorrichtungen auskommt. Über einer Einschleusungsvorrichtung (vorzugsweise Syphon oder Mischerschnecke) wird z. B. stapelbare Biomasse/Substrat bevorratet, die/das kontinuierlich oder semikontinuierlich dem auf einer Schiefen Ebene angeordneten Gleitschicht-Fermenter zugeführt wird. Das Substrat gleitet dabei im Sinne des Hangabtriebs auf einer flüssigen Gleitschicht, wobei die "Fließgeschwindigkeit" vom Neigungswinkel des Fermenters, dem Substrat-Gewicht im Einschleusungsbereich, der Ausbildung und Qualität der Gleitflüssigkeit (Faulschlamm), der Reibung an den Fermenterwänden, vor allem aber der Einstellung einer mechanischen oder hydraulischen Bremsvorrichtung im Ausschleusungsbereich abhängt.
Somit hat die Vorrichtung einen 3-teiligen Aufbau: eine Einschleusungsvorrichtung, einen quaderförmigen oder röhrenförmigen modular erweiterbaren Fermenter-Teil und einen Ausschleusungsteil.
Die Einschleußung der Biomasse erfolgt vorzugsweise über eine syphonartige Ausbildung, so daß neben dem sicheren hydraulischen Gasverschluß eine Vortemperierung und Inoculation des Substrates gewährleistet ist. Der sich langsam voranschiebende Masse-Strom gelangt schließlich

in den Fermenterteil. In dessen vorderem Bereich befinden sich eine Vorrichtung (z. B. ein mit Preßluft beaufschlagbares Luftkissen) zur evtl. erforderlich werdenden Überwindung der anfänglichen Haftreibung sowie eine Vorrichtung (z. B. Rechen) zur Totalentleerung. Auf dem Fermenterboden bildet sich - vornehmlich durch die laufende Rezirkulation des entstehenden Perkolats - eine Gleitschicht, auf welcher das Substrat gleitend aufschwimmt. Der Fermenterteil schließt mit einer Staunase ab, die den Erhalt des Gleitfilms garantiert. Das Sammeln des Biogases im oberen Fermenterbereich erfolgt über längsverlaufende und überlappend angeordnete beheizbare Abdeckelemente, zwischen welchen Schlitze für den Gasabzug sorgen. In diese Abdeckelemente sind auch die Verteilvorrichtungen (z. B. Überlaufgerinne) für das Perkolat integriert. Der Ausschleusungsteil besteht vorzugsweise aus einer luftdichten formlabilen Haube mit einer versteifbaren Rückwand, über welche über einstellbare Preßdrücke die Fließgeschwindigkeit des Substrat-Stroms reguliert werden kann. Dabei kann die Ausschleusung soweit gedrosselt werden, daß auch fließfähiges Substrat verarbeitet werden kann. Gleichzeitig befindet sich im Ausschleusungsteil eine Abtropfvorrichtung (z. B. eine Rollenstrecke oder perforierter Boden) zum Sammeln des Perkolats, welches über einen Wärmetauscher temperiert in den Fermenter rezirkuliert wird. Für eine allenfalls notwendig werdende Mischung von Faulsubstrat mit Biomasse (Frischsubstrat) befindet sich entweder im Ein- oder Auschleusungsteil eine temperierbare Mischvorrichtung.

Schutzansprüche

Vorrichtung zur Methanisierung von Substraten unterschiedlicher Konsistenz in einem kontinuierlich bzw. semikontinuierlich arbeitenden Gleitschicht-Fermenter dadurch gekennzeichnet, daß

(1) bevorratete Biomassen/Substrate vorzugsweise über eine - vorzugsweise temperierbare syphonartige - Einschleusungsvorrichtung (1) in einen schrägliegenden Fermenter (2) eingeleitet werden

(2) nach Anspruch 1 sich auf dem Fermenterboden eine hydraulische Gleitschicht (3) ausbildet,

(3) nach Anspruch 1 und 2 der aus den Baueinheiten Einschleusung - Fermenterteil - Ausschleusung bestehende Fermenter modular aufgebaut ist

(4) nach Anspruch 1-3 eine mechanische Phasentrennung (4) im Ausschleusungsbereich erfolgt,

(5) nach Anspruch 1 -4 das temperierte Perkolat rezirkuliert wird

(6) nach Anspruch 1- 5 die hydraulische Gleitschicht (3) über eine Staunase (6) erhalten wird

(7) nach Anspruch 1- 6 der Fermenter quaderförmigen, runden oder ovalen Querschnitt besitzt

(8) nach Anspruch 1- 7 eine hydraulische, pneumatische oder mechanische Vorrichtung (7) zur Überwindung von Haftreibung eingesetzt wird, die durch eine Vorrichtung (8) zur Totalentleerung ergänzt wird

(9) nach Anspruch 1- 8 die Inoculation der Biomasse in der Einsschleußungsvorrichtung vorwiegend durch Diffusion erfolgt

(10) nach Anspruch 1- 9 die Einspeisung für das Perkolat (5a) sich im Bereich der sich überlappenden Beplankungen (9), der Perkolatabzug (5b) sich im Auschschleußungsteil befinden

(11) nach Anspruch 1- 10 die Fließgeschwindigkeit des Substratvorschubs durch die druckbeaufschlagte Fermenterwand (12) stufenlos steuerbar ist

(12) nach Anspruch 1- 11 der Gasabzug (10) sowohl durch eigenen Gasdruck, als auch durch

aktive Absaugung erfolgt

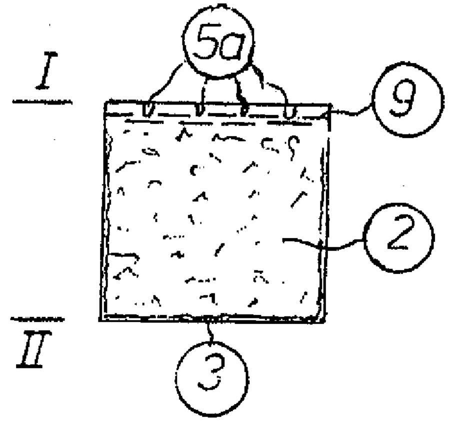
(13) nach Anspruch 1- 12 daß eine gasdichte flexible Schürze (11) drückend oder angesogen die Substratoberfläche im Ausschleusungsteil abschließt

(14) nach Anspruch 1- 13 sich im Ein- oder Ausschleusungsteil eine vorzugsweise beheizbare Mischvorrichtung (13) befindet

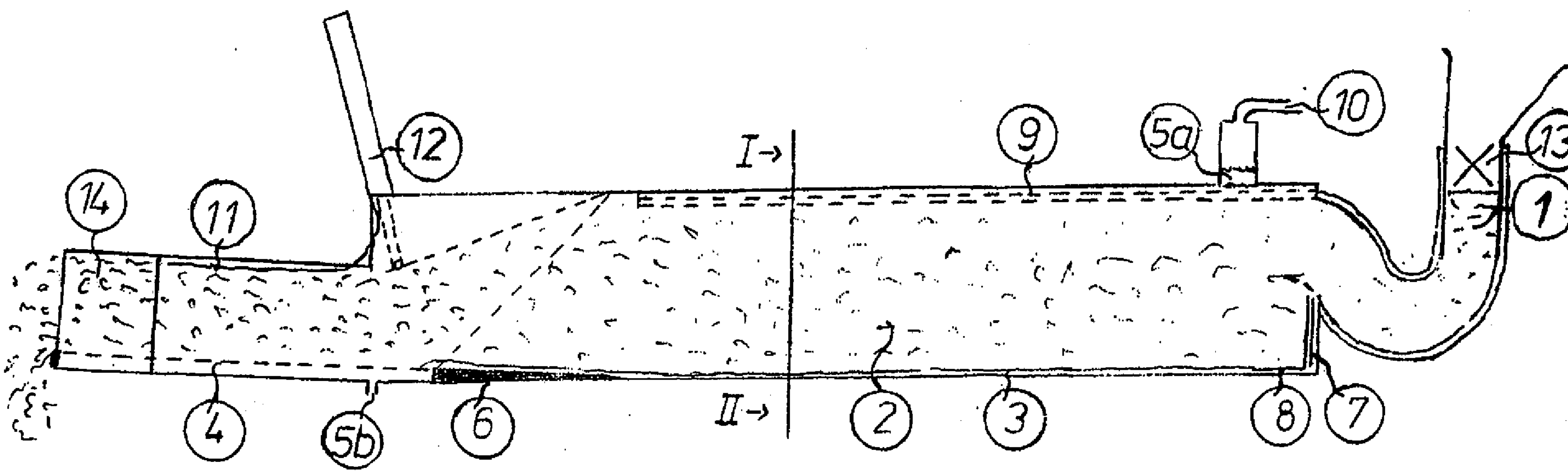
(15) nach Anspruch 1 - 14 sich entweder im Einschleusungs oder Ausschleusungsteil eine Hygenisierungsvorrichtung (14) befinden kann.

09.02.99

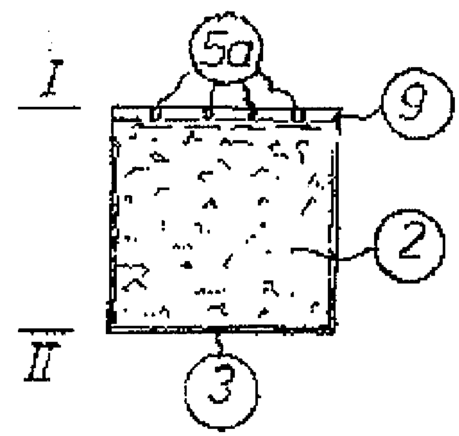
Figur 2 Querschnitt



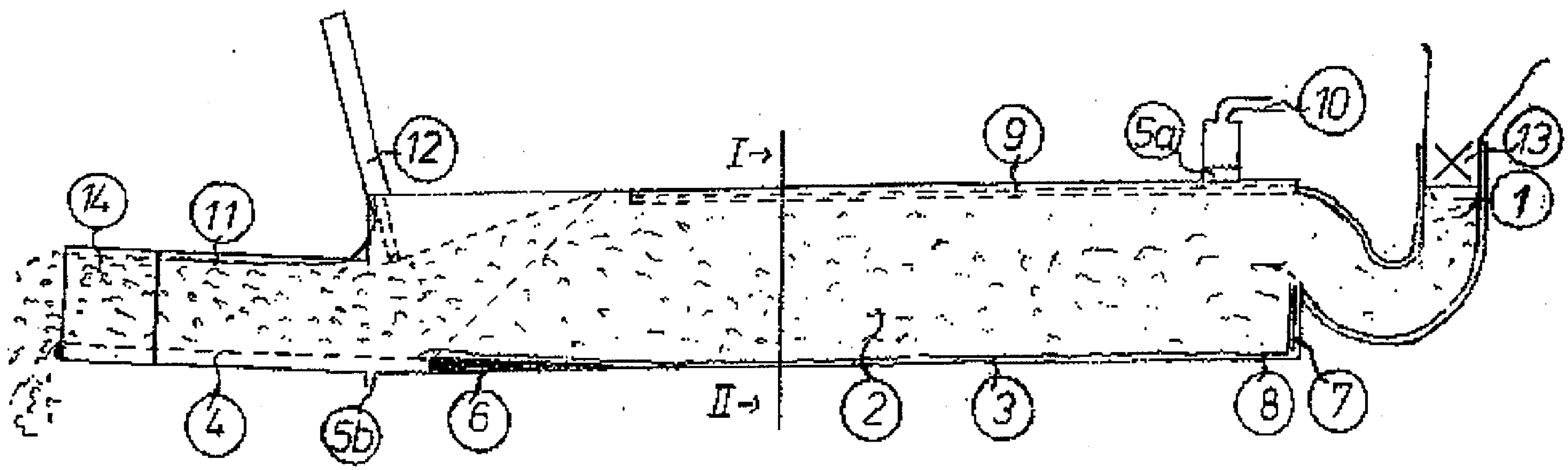
Figur 1 Längsprofil



Figur 2 Querschnitt



Figur 1 Längsprofil



(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENT- UND MARKENAMT

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(10) **DE 100 05 390 A 1**

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(72) Erfinder:
gleich Anmelder

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Vorrichtung und Verfahren zur Methanisierung von Substraten unterschiedlicher Konsistenz in einem kontinuierlich bzw. semikontinuierlich arbeitenden Gleitschicht-Fermenter

(57) Bei der vorgestellten Erfindung handelt es sich um ein Verfahren und eine Vorrichtung, bei welcher Substrate unterschiedlicher Konsistenz wahlweise kontinuierlich oder semikontinuierlich in einem Gleitschicht-Fermenter methanisiert werden können. Es ist ein einstufiges Vergärungsverfahren, welches mit einem Minimum an technischen Vorrichtungen auskommt.
Über eine Einschleusungsvorrichtung (Syphon, Preßkolben oder Micherschnecke) wird das Gärgut kontinuierlich oder semikontinuierlich dem auf einer schiefen Ebene angeordneten Gleitschicht-Fermenter zugeführt. Das Substrat gleitet dabei im Sinne des Hangabtriebs auf einer flüssigen Gleitschicht. Im Ausschleusungsteil ist eine Vorrichtung, welche den Substratstrom soweit drosseln kann, so daß auch fließfähiges Substrat verarbeitet werden kann. Die Substraterwärmung erfolgt über die Berieselung oder Anmischung mit vorgewärmter Impf- bzw. rezirkulierter Perkolatflüssigkeit, welche gleichzeitig als Gleitschicht dient.

DE 100 05 390 A 1

Beschreibung

Zur Biogasgewinnung werden methanisierbare Biomassen (z. B. Gülle oder Klärschlämme) entweder in flüssiger Form (Naß-Vergärung) oder in halbfeuchter Form (Trocken-Vergärung) in Fermentern mikrobiologisch genutzt. Die im landwirtschaftlichen oder kommunalen Bereich favorisierte Naß-Vergärung von Gülle oder Klärschlamm ist vorwiegend auf deren betriebsinterne Verwertung abgestellt. Wegen der geringen Energiedichte z. B. der Gülle lohnt sich kein Transport, was im Regelfall über die Größe dieser Anlagen deren Wirtschaftlichkeit begrenzt. Zudem müssen ausbeutungswürdige Biomassen (z. B. Rasenschnitte, Gras, Maishäcksel, Bioabfall) erst in einen pumpfähigen Zustand gebracht, laufend homogenisiert und auch als Flüssigkeit auf den landwirtschaftlichen Nutzflächen verteilt werden. Die vorgestellte Erfindung bezieht sich vorzugsweise auf eine Trocken-Vergärung.

Zur Trockenen Vergärung sind mehrere Verfahrensvarianten bekannt:

- diskontinuierliche Batch-Verfahren und
- kontinuierliche bzw. semikontinuierliche Verfahren.

Den kontinuierlichen bzw. semikontinuierlichen Trocken-Gär-Verfahren ist gemeinsam, daß der Substrattransport im Fermenter entweder über Schwerkraft (fall-down-Prinzip), bzw. mechanisch (Transportschnecke oder Zinkenförderer) oder in geschobenen Spezialbehältern (Gärkanalverfahren) erfolgt.

Bei der vorliegenden Erfindung handelt es sich um eine Vorrichtung zur wahlweisen Naß- oder Trocken-Vergärung in einem Gleitschicht-Fermenter, welcher im Längsprofil (Fig. 1) und Querschnitt (Fig. 2) vorgestellt wird. Dabei wird von einem stufenlos steuerbaren kontinuierlich arbeitenden einphasigen Vergärungsverfahren ausgegangen, welches mit einem Minimum an technischen Vorrichtungen auskommt.

Über eine Einschleusungsvorrichtung (Syphon, Preßkolben oder Mischerschnecke) wird das Gärgut kontinuierlich oder semikontinuierlich dem auf einer Schiefen Ebene angeordneten Gleitschicht-Fermenter zugeführt. Das Substrat gleitet dabei im Sinne des Hangabtriebs auf einer flüssigen Gleitschicht, wobei die "Fließgeschwindigkeit" vom Neigungswinkel des Fermenters, dem Substrat-Gewicht, insbesondere der Ausbildung und Qualität der Gleitflüssigkeit (Faulschlamm), der Reibung an den Fermenterwänden, vor allem aber der Einstellung einer mechanischen, pneumatischen oder hydraulischen Bremsvorrichtung im Ausschleusungsbereich abhängt.

Somit hat die Vorrichtung einen 3-teiligen Aufbau:

- eine Einschleusungsvorrichtung,
- einen quaderförmigen oder röhrenförmigen modular erweiterbaren Fermenter-Teil und
- einen Ausschleusungsteil.

Im gasdichten Einschleusungsteil kann auch eine Vortemperierung und Inoculation des Substrates erfolgen. Der sich langsam voranschiebende Masse-Strom gelangt in den Fermenterteil, in dessen vorderem Bereich sich eine Vorrichtung (z. B. ein mit Preßluft beaufschlagbares Luftkissen) zur evtl. erforderlich werdenden Überwindung der anfänglichen Haftreibung sowie eine Vorrichtung (z. B. Rechen) zur Totalentleerung befinden können. Auf dem Fermenterboden bildet sich – vornehmlich durch die laufende Rezirkulation des entstehenden Perkolats – eine Gleitschicht, auf welcher das Substrat gleitend aufschwimmt. Der Fermenterteil

schließt so ab, daß der Erhalt des Gleitfilms garantiert ist. Das Sammeln des Biogases und das Einbringen des Perkolats im oberen Fermenterbereich erfolgt über längsverlaufende und überlappend angeordnete Abdeckelemente, Rohre, Schläuche, etc. Der Ausschleusungsteil besteht aus einer luftdichten formlabilen Haube mit einer versteifbaren Rückwand, durch welche über einstellbare Preßdrücke die Fließgeschwindigkeit des Substrat Stroms reguliert werden kann, oder einem Zweckdienlichen Formteil. Dabei kann die Ausschleusung soweit gedrosselt werden, daß auch fließfähiges Substrat verarbeitet werden kann. Gleichzeitig befindet sich im Ausschleusungsteil eine Abtropfvorrichtung (z. B. eine Rollenstrecke oder perforierter Boden) zum Sammeln des Perkolats, welches über einen Wärmetauscher temperiert rezirkuliert wird. Für eine allenfalls notwendig werdende Mischung von Faulsubstrat (Restgut) mit Biomasse (Frischsubstrat) befindet sich entweder im Ein- oder Ausschleusungsteil eine temperierbare Mischvorrichtung.

Patentansprüche

1. Vorrichtung zur Methanisierung von Substraten unterschiedlicher Konsistenz in einem kontinuierlich bzw. semikontinuierlich arbeitenden Gleitschicht-Fermenter, **dadurch gekennzeichnet**, daß im Einschleusungsteil bevorratbare, temperierbare und mischbare Biomassen/Substrate über eine geeignete Einschleusungsvorrichtung, Syphon, Preßkolben, Mischerschnecke (1) in einen schrägliegenden Fermenter (2) eingeleitet werden.
2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß auf dem Fermenterboden eine hydraulische Gleitschichtausbildung (3) erzielt wird.
3. Vorrichtung nach Anspruch 1 und 2, dadurch gekennzeichnet, daß der aus den Baueinheiten "Einschleusung" - "Fermenterteil" - "Ausschleusung" bestehende Fermenter modular aufgebaut ist.
4. Vorrichtung nach Anspruch 1–3, dadurch gekennzeichnet, daß eine Phasentrennung (4) im Ausschleusungsteil erfolgt.
5. Vorrichtung nach Anspruch 1–4, dadurch gekennzeichnet, daß das temperierte Perkolat rezirkuliert wird.
6. Vorrichtung nach Anspruch 1–5, dadurch gekennzeichnet, daß die hydraulische Gleitschicht (3) manipuliert (Staunase, Staurechen, etc.) werden kann (6).
7. Vorrichtung nach Anspruch 1–6, dadurch gekennzeichnet, daß der Fermenter einen formstabilen oder -labilen quaderförmigen, runden oder ovalen Querschnitt besitzt.
8. Vorrichtung nach Anspruch 1–7, dadurch gekennzeichnet, daß eine hydraulische, pneumatische oder mechanische Vorrichtung (7) zur Überwindung von Haftreibung im Bedarfsfall eingesetzt und die durch eine Vorrichtung (8) zur Totalentleerung ergänzt werden kann.
9. Vorrichtung nach Anspruch 1–8, dadurch gekennzeichnet, daß die Inoculation der Biomasse in der Einschleusungsvorrichtung vorwiegend durch Diffusion erfolgt.
10. Vorrichtung nach Anspruch 1–9, dadurch gekennzeichnet, daß die Einspeisung für das Perkolat (5a) sich im oberen Fermenterteil (9), der Perkolatabzug (5b) sich im Ausschleusungsteil befinden.
11. Vorrichtung nach Anspruch 1–10, dadurch gekennzeichnet, daß die Fließgeschwindigkeit des Substratvorschubs stufenlos steuerbar ist.
12. Vorrichtung nach Anspruch 1–11, dadurch ge-

kennzeichnet, daß der Gasabzug (10) sowohl durch eigenen Gasdruck, als auch durch aktive Absaugung erfolgen kann.

13. Vorrichtung nach Anspruch 1–12, dadurch gekennzeichnet, daß daß eine flexible Schürze (11) oder ein zweckdienliches Formelement den Fermenterteil im Ausschleusungsteil abschließt.

14. Vorrichtung nach Anspruch 1–13, dadurch gekennzeichnet, daß sich im Ein- oder Ausschleusungsteil eine beheizbare Mischvorrichtung (13) befinden kann.

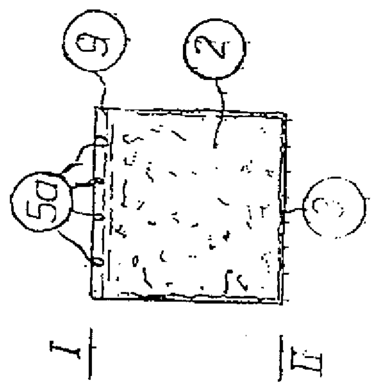
15. Vorrichtung nach Anspruch 1–14, dadurch gekennzeichnet, daß sich entweder im Einschleusungs- oder Ausschleusungsteil eine Hygenisierungsvorrichtung (14) befinden kann.

Hierzu 1 Seite(n) Zeichnungen

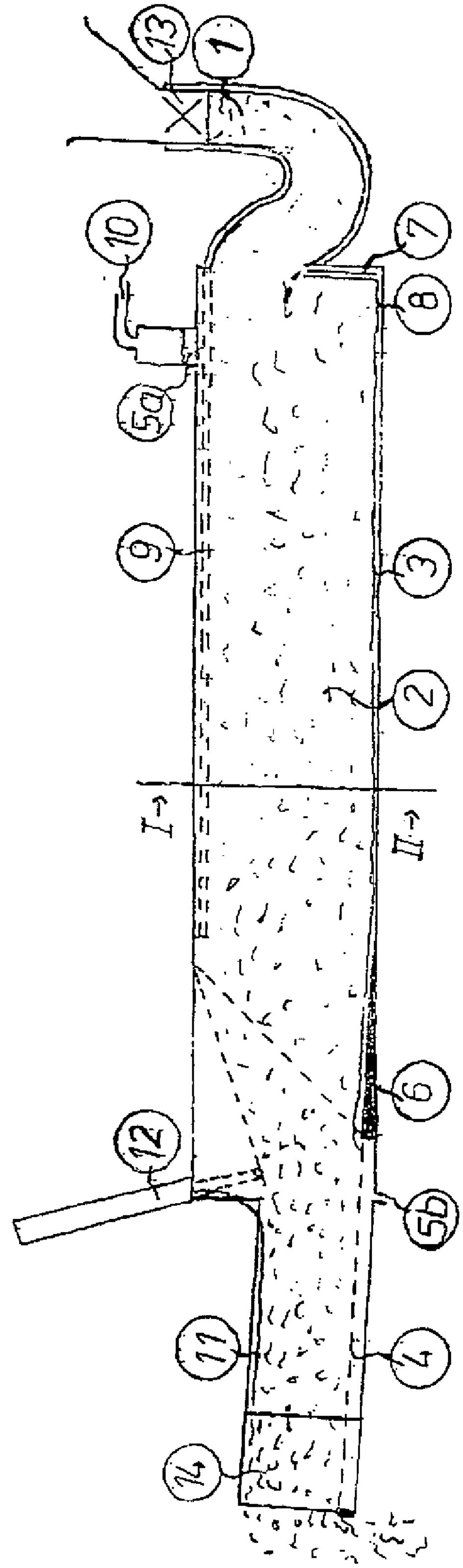
ZEICHNUNGEN SEITE 1

Nummer: DE 100 05 390 A1
Int. Cl.⁷: C 12 M 1/107
Offenlegungstag: 10. August 2000

Figur 2 Querschnitt



Figur 1 Längsprofil



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A1

DEMANDE DE BREVET D'INVENTION

(21) N° 79 19255

(54) **Dispositif mobile pour la production en continu et le stockage du gaz de fermentation des déchets cellulosiques.**

(51) Classification internationale (Int. Cl.[3]). C 12 M 1/00; A 01 C 3/02; C 12 P 5/02.

(22) Date de dépôt .... 24 juillet 1979.

(33) (32) (31) Priorité revendiquée :

(41) Date de la mise à la disposition du public de la demande .... B.O.P.I. — « Listes » n° 6 du 6-2-1981.

(71) Déposant : MAUMONT Amaury et ROSSIGNOL Alain, résidant en France.

(72) Invention de : Amaury Maumont et Alain Rossignol.

(73) Titulaire : *Idem* (71)

(74) Mandataire :

La présente invention se rapporte à la production et au stockage de gaz de fermentation anaérobie de déchets cellulosiques tels que : sciure et copeaux de bois, vieux papiers, fumier, résidus de vinification, rafle d'épis de maïs, etc...

De tels dispositifs existent déjà mais ils ont l'inconvénient de faire appel à des constructions en maçonnerie, de fonctionner en discontinu et de nécessiter des moyens de manutention.

L'originalité du procédé selon l'invention consiste à utiliser une vis sans fin pour provoquer un brassage favorable à la réaction et un déplacement du fumier au cours de la fermentation.

L'invention permet de réaliser des cuves de fermentation de petites dimensions qui peuvent être munies de roues et déplacées.

Le dôme souple utilisé comme capacité gazométrique conformément au brevet n° 7700202 est constitué de toute manière convenable par un film imperméable au gaz doublé d'un produit isotherme.

L'étanchéité entre la bâche et la cuve n'est plus assurée par un joint hydraulique mais par serrage mécanique sur un joint de caoutchouc.

Le fumier frais, qui vient de l'étable, tombe dans une trémie 1 où se développe une fermentation aérobie qui en élève la température.

La vis 2 entraînée par un moto réducteur 3 pousse le fumier dans la cuve où sa température est maintenue par un tuyau d'eau chaude 7 pouvant provenir du refroidissement d'un groupe électrogène ou d'un groupe compresseur.

Une fermentation anaérobie commence à se développer. De l'eau est maintenue jusqu'au niveau 4 .

Le gaz produit 5 est stocké dans la bâche isotherme 6.

La vis 2 continue de pousser le fumier lentement vers la sortie où il tombe en fin de fermentation par la goulotte 8 dans une benne 9

L'ensemble du dispositif est muni de roues 10 pour être déplacé aisément et de pieds 11 pour être stabilisé à la hauteur désirée.

Les déperditions calorifiques sont limitées par un isolant 12

Le dispositif objet de l'invention peut être utilisé pour la production de gaz, à partir de petites quantités de fumier, d'une façon automatique et continue.

La capacité gazométrique souple permet de stocker le gaz produit la nuit et qui sera utilisé le jour ou réciproquement.

A titre d'exemple une étable de 40 vaches produisant 500 Kg de fumier / jour nécessiterait une cuve d'environ 20 m3 et produirait 4 400 thermies / an soit l'équivalent de 4, 4 tonnes de fuel.

Une telle production serait suffisante pour les besoins de l'habitation d'un exploitant agricole.

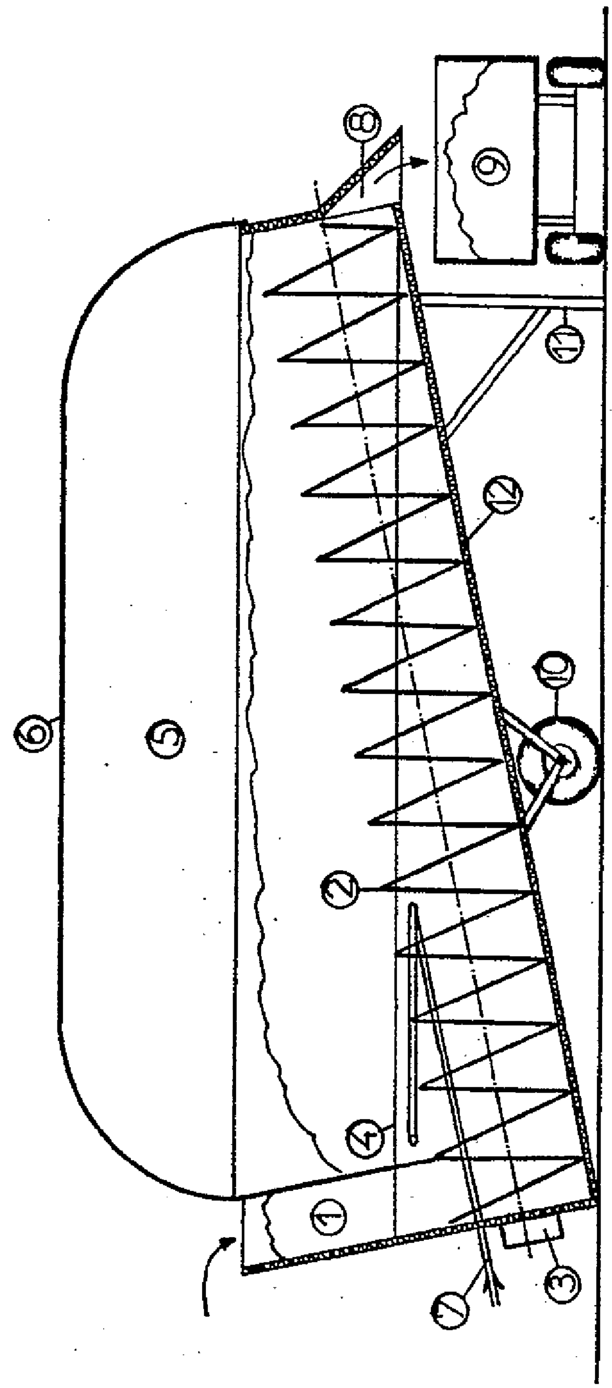
REVENDICATIONS

Dispositif permettant la fermentation dans l'eau de déchets cellulosiques à l'abri de l'air et caractérisé par le fait qu'il fonctionne en continu grâce à une vis sans fin qui déplace les produits tout au long de la fermentation depuis l'entrée jusqu'à la sortie.

Dispositif selon la revendication 1 caractérisé par le fait que cette vis sans fin provoque aussi un brassage des produits largement favorable à la fermentation.

Le dispositif selon la revendication 1 est aussi caractérisé par le fait qu'il est facilement mobile.

Le dispositif selon la revendication 1 est aussi caractérisé par le fait qu'il dispose d'une capacité gazométrique constituée d'un dôme souple isotherme pour éviter les déperditions calorifiques.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